



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/081.661	02/22/2002	Soo-geun Lee	SAM-0313	2089

7590 10/15/2003

Steven M. Mills  
MILLS & ONELLO LLP  
Suite 605  
Eleven Beacon Street  
Boston, MA 02108

EXAMINER

NGUYEN, HA T

ART UNIT	PAPER NUMBER
----------	--------------

2812

DATE MAILED: 10/15/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	<b>Application No.</b> 10/081,661	<b>Applicant(s)</b> LEE ET AL.	
	<b>Examiner</b> Ha T. Nguyen	<b>Art Unit</b> 2812	

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 08 July 2003.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-21 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-21 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.  
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All b) ☐ Some \* c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).  
\* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).  
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                                   | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____  |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                          | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) <u>0703</u> | 6) <input type="checkbox"/> Other: _____                                    |

## **DETAILED ACTION**

### ***Notice to applicant***

1. Applicants' Amendment and Response to the Office Action mailed March 6, 2003 and request for an RCE have been entered and made of record. Following is an Office Action responding to the request.

### ***Response to Amendment***

2. In view of Applicants' arguments and the amendment to the claims, the rejections of claims 1-18 under 35 U.S.C. 103, as stated in the previous Office Action, have been withdrawn.

Applicants are referred to the new ground of rejection given below.

### ***Claim Objections***

3. Claims 1-21 are objected to because of the following informalities: In claim 1, line 16, deletion of "and the trench" is suggested for correctness. Appropriate correction is required.

Claims 2-21 variously depend from claim 1, they are objected to for the same reason.

### ***Claim Rejections - 35 USC § 103***

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was

Art Unit: 2812

made in order for the examiner to consider the applicability of 35 U.S.C. 103<sup>©</sup> and potential 35 U.S.C. 102(f) or (g) prior art under 35 U.S.C. 103(a).

5. Claims 1-8, 11-13, and 15-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lin (U.S. Patent 5989997) in view of Lui et al. (U.S. Patent 6391761, hereinafter "Lui").

[Claims 1 and 19-21] Referring to Figs. 3A-3D and related text, Lin discloses a method of fabricating an interconnection line in a semiconductor device comprising the steps of : forming a first interlayer insulating layer 132 on a lower conductive layer 131 which is formed on a semiconductor substrate 130; forming a second etching stopper 133 on the first interlayer insulating layer; forming a second interlayer insulating layer 134 over the second etching stopper ; etching the second interlayer insulating layer, the second etching stopper, and the first interlayer insulating layer sequentially to form a via hole aligned with the lower conductive layer (see col. 4, lines 1-30 ); forming a protective layer 138 to protect a portion of the lower conductive layer exposed at the bottom of the via hole, the protective layer filling the via hole and extending across the via hole; etching a portion of the second interlayer insulating layer adjacent to the via hole using the second etching stopper as an etching stopping point to form a trench connected to the via hole (see Fig. 3C); removing the protective layer (see Fig. 3D); and forming an upper conductive layer 144 that fills the via hole and the trench and is electrically connected to the lower conductive layer (See Fig. 3D). But it does not disclose expressly forming a first etching stopper on the lower conductive layer, using the first etching stopper as an etching stopping point to form a via hole ; and removing the portion of the first etching stopper positioned at the bottom of the via hole. However, the missing limitations are well known in the art because Lui discloses these feature (see Fig. 10 ). A person of ordinary skill is motivated to modify Lin with Lui to obtain a better control of the etching.

[Claims 2 and 18 ] Lin also discloses upper metal conductive layer is of copper (see col. 5, lines 26-29). The combined teaching of Lin and Lui does not disclose that the lower conductive layer is also of copper. However it would have been obvious to a person of ordinary skill to do so to reduce resistance of the device.

[Claims 3 and 6] Lui also discloses wherein the first and second etch stoppers are formed of at least one of silicon nitride or carbide (see col. 3, lines 60-67 and col. 4, lines 8-18); and

[Claims 4, 5, 7, and 8] wherein the first and second interlayer insulating layers are formed of a low dielectric constant material (see col. 4, lines 1-25), besides, the examiner takes Official Notice that carbon doped silicon oxide is a low k dielectric commonly used in semiconductor devices.

[Claims 11-13 and 15-17] The combined teaching of Lin and Lui discloses substantially the limitations of claims 11-13, and 15-17, as shown above. Lin also discloses etching back the protective layer so that the upper surface of the protective layer is lower than the upper surface of the second interlayer insulating layer, the use of TMAH resist developer (see Fig. 3B and col. 4, lines 56-66, col. 5, lines 22-32). But it does not disclose expressly the use of HF solution diluted with water in the wet etching method. However, the examiner takes Official Notice that diluted HF solution is also a commonly etchant used in wet etching.

Therefore, it would have been obvious to combine Lin with Lui to obtain the invention as specified in claims 1-8, 11-13 and 15-21.

6. Claims 9, 10, and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lin in view of Lui, as applied to claims 1-8 and 18-21 above, and further in view of Nashner et al. (U.S. Patent 6465358, hereinafter "Nashner").

The combined teaching of Lin and Lui discloses substantially the limitations of claims 9, 10, and 14, as shown above. Lui also disclose an inorganic dielectric protective layer (see col. 4, lines 42-62).

But it does not disclose expressly that the dielectric protective layer is of spin-on type, and that the protective layer is removed by a wet etching using a HF solution diluted with water.

However, the missing limitations are well known in the art because Nashner discloses this feature (See col. 4, lines 17-32 and col. 6, line 45-col.7, line 29), besides the examiner takes Official Notice that HSQ is one of the SOG materials commonly used in semiconductor devices .

A person of ordinary skill is motivated to modify Lin and Lui with Nashner to obtain better etch control and device with less contaminants or residues.

Therefore, it would have been obvious to combine Lin and Lui with Nashner to obtain the invention as specified in claims 9, 10, and 14.

***Conclusion***

7. The prior art relevant to the disclosure of this application and not being used in the rejections.

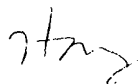
US Patent 6319815 to Iguchi et al. for teaching the use of etch stoppers and sacrificial plug.

US Patent 6093966 to Venkatraman et al. for teaching the use of different low k dielectrics.

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ha Nguyen whose telephone number is (703)308-2706 . The examiner can normally be reached on Monday-Friday from 8:30AM to 6:00PM, except the first Friday of each bi-week. The phone number for Wednesday is (703) 560-0528.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John Niebling, can be reached on (703) 308-3325. The fax phone number for this Group is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956.



Ha Nguyen  
Primary Examiner  
10 - 2 - 03